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Versatility of the humble seaweed in biomanufacturing

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CONICYT Ministerio de Educación Gobierno de Chile

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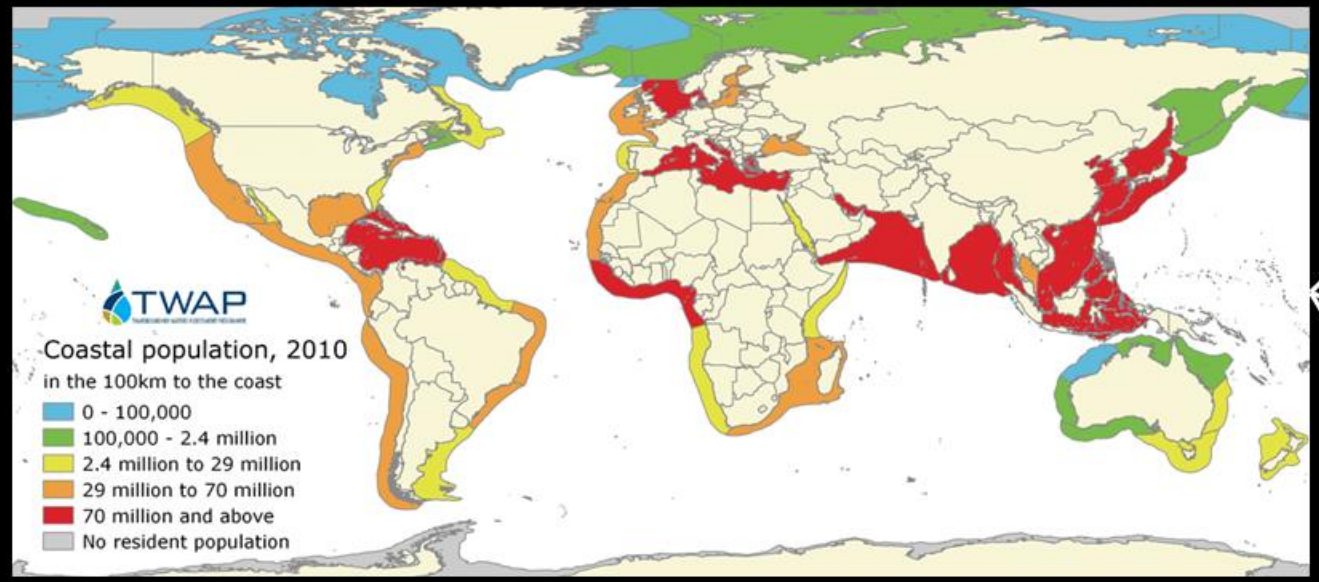
Seaweed

- Types: Green, Brown and Red
- Diverse biological characteristics
- May grow in diverse environments

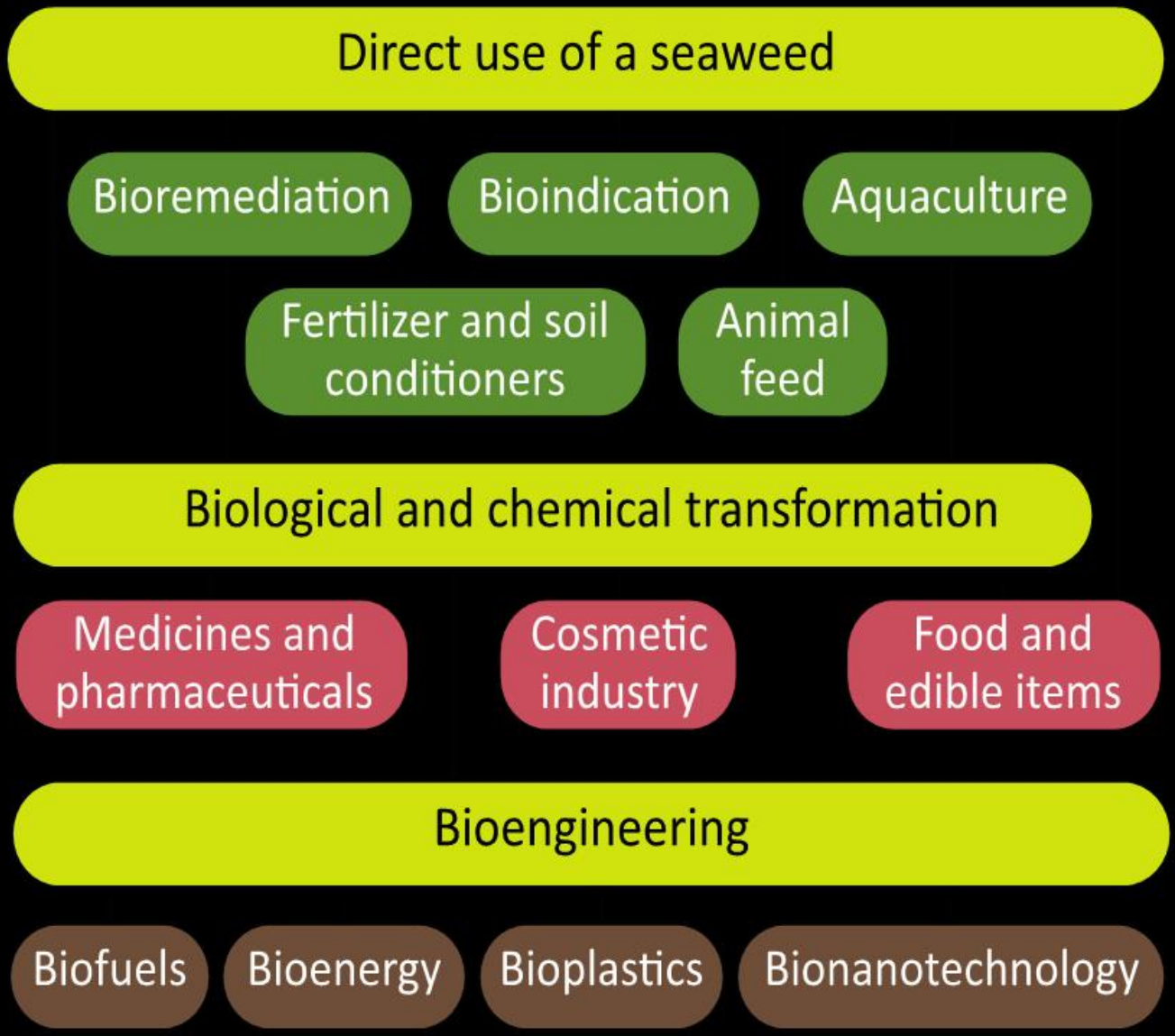
Sustainability



- More than half of population lives at the coast (<100 km)
- 71% of world surface belongs to the oceans
- Macroalgae cultures bioremediate organic contamination
- Macroalgae may be later used to produce biofuels, bioplastics, food, medicines…

Uses in biomanufacturing

- FOOD
- ENERGY
- HEALTH
- MATERIALS



Byproducts

ENVIRONMENT

- **Fertilizers**
- **Soil conditioners**
- **Aquaculture**

Eutrophication control
Antifungal
Water footprint
Climate change

MEDICINE

- **Medicines**
- **Biomedical parts**

Antimicrobial
Antiviral
Anti-inflamatory
Anticoagulant
Anticancer
Anti-allergy

Extracts from Seaweed

Polysaccharides
Proteins
Polyphenols
Pigments
Conjugated fatty acids

NUTRITION

Antioxidant
Nutritional benefits
Healthcare
Inmunity enhancement

- **Food supplements**
- **Feed aditives**
- **Animal**
- **Cosmetics**

FUELS & BIO-MATERIALS

- **Bio-crude**
- **Bio-char**
- **Bio-gas**
- **Bio-plastics**
- **Bio-nanoparticles**

Renewable energy
Eco-friendly fuels
Biodegradable waste

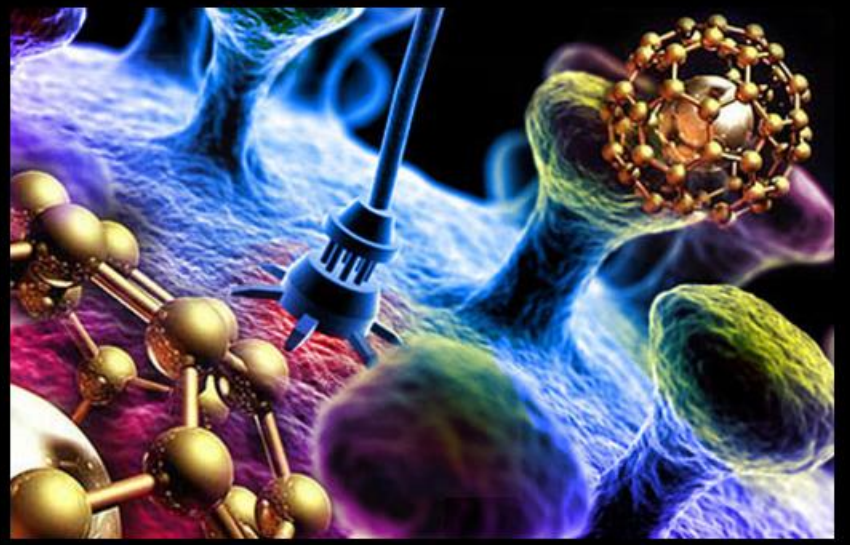
Bioplastics

- Similar characteristics to those obtained from crude (properties and fabrication)
- Biodegradable and renewability (Environmentally friendlier)
- No toxicity at human feeding activities neither implantable materials
- More resistant to microwave radiation, less brittle and durable
- PHA and PHB are green substitutes of polypropylene

Biofuels

- Advantages compared to terrestrial plants
  - efficiency on photosynthesis
  - no competition for habitat
  - reduction in eutrophication and toxicity
  - easier production
  - higher methanogenic potential and EROI (energy return of investment)
- Bio-crude and bio-chars with high energy output
- Energy produced by direct combustion is more efficient than coal power plant

Bionanotechnology



- Mediation of synthesis of metal Nanoparticles
- Metal nanoparticles (Ag, Au, Fe and Pt)
- Metal oxide nanoparticles (Cu, Zn and Fe oxides)
- Biosynthesis is still not well understood

Conclusions

- Accelerated growth, regeneration and easy cultivation
- Address global environmental issues and avoid competition with other land activities
- Numerous natural properties and bioactive compounds
  - Treat cancer
  - Power engines
  - Biodegradable plastics
  - …
- However, further research on biomanufacturing processes is needed to develop competitive, healthy and more sustainable methods

Thank you!